# A FIELD INSTITUTE OF GLACIOLOGICAL AND EXPEDITIONARY SCIENCES IN ALASKA

By

MAYNARD M. MILLER

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# A FIELD INSTITUTE OF GLACIOLOGICAL[1] AND EXPEDITIONARY SCIENCES IN ALASKA

*by* MAYNARD M. MILLER

THE OCEAN, ATMOSPHERE, and land areas surrounding the Arctic and Antarctic are of increasing importance to all nations, an importance not only scientific but economic, political, and strategic as well. In America it is particularly emphasized by the manner in which the new state of Alaska is being developed, by the basic motivation behind much of the recent International Geophysical Year programming in the earth and atmospheric sciences, and by the extensive commercial and military enterprises initiated in recent years in northern Canada and Greenland. Information collected from polar research has applications in many areas of science and education. There are fundamental problems in temperate regions which can also be solved through a basic first-hand understanding of glaciology and related disciplines.

In the past, glaciological work has often been insufficient and inadequate or too restricted in scope to permit true understanding of a region. It has become clear that solutions to many of the most pressing problems in this science require continued or periodically repeated field observations in ice-covered areas, preferably over a number of years. Yet the number of capable scientists engaged in research in polar regions is appallingly small, and it is to the colleges and universities that we must look for the training of personnel to fill this important need.

To provide both for training potential polar scientists and for a research-centered field station, the Summer Institute of Glaciological Sciences was established in 1961 by the Foundation for Glacier Research of Seattle, Washington, and the Glaciological Institute at Michigan State University. With headquarters in Juneau, Alaska, the Institute is located on the Juneau Icefield

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MAYNARD M. MILLER is at present on leave of absence from Michigan State University, where he is a professor in the Geology Department, to take part in the American Everest Expedition. From their inception in 1946, he has kept APPALACHIA readers informed of the progress of studies on the Juneau Icefield. A member of the A.M.C., he has visited fifty-five countries around the globe on some thirty expeditions.

[1] Glaciology is the science of existing glaciers, as opposed to glacial geology which deals with problems and earth features related to former glaciations. No longer a descriptive subject, today it is a science with many facets, requiring a truly inter-disciplinary approach and involving many subjects. Among these are the fields of geology, hydrology, polar oceanography, geophysics, meteorology/climatology, Arctic/alpine botany, surveying, photogrammetry, thermodynamics, soil mechanics, and even anthropology. As such it is a "derived field" which allows progress to be made in areas not possible via the restricted route of a single classical discipline.

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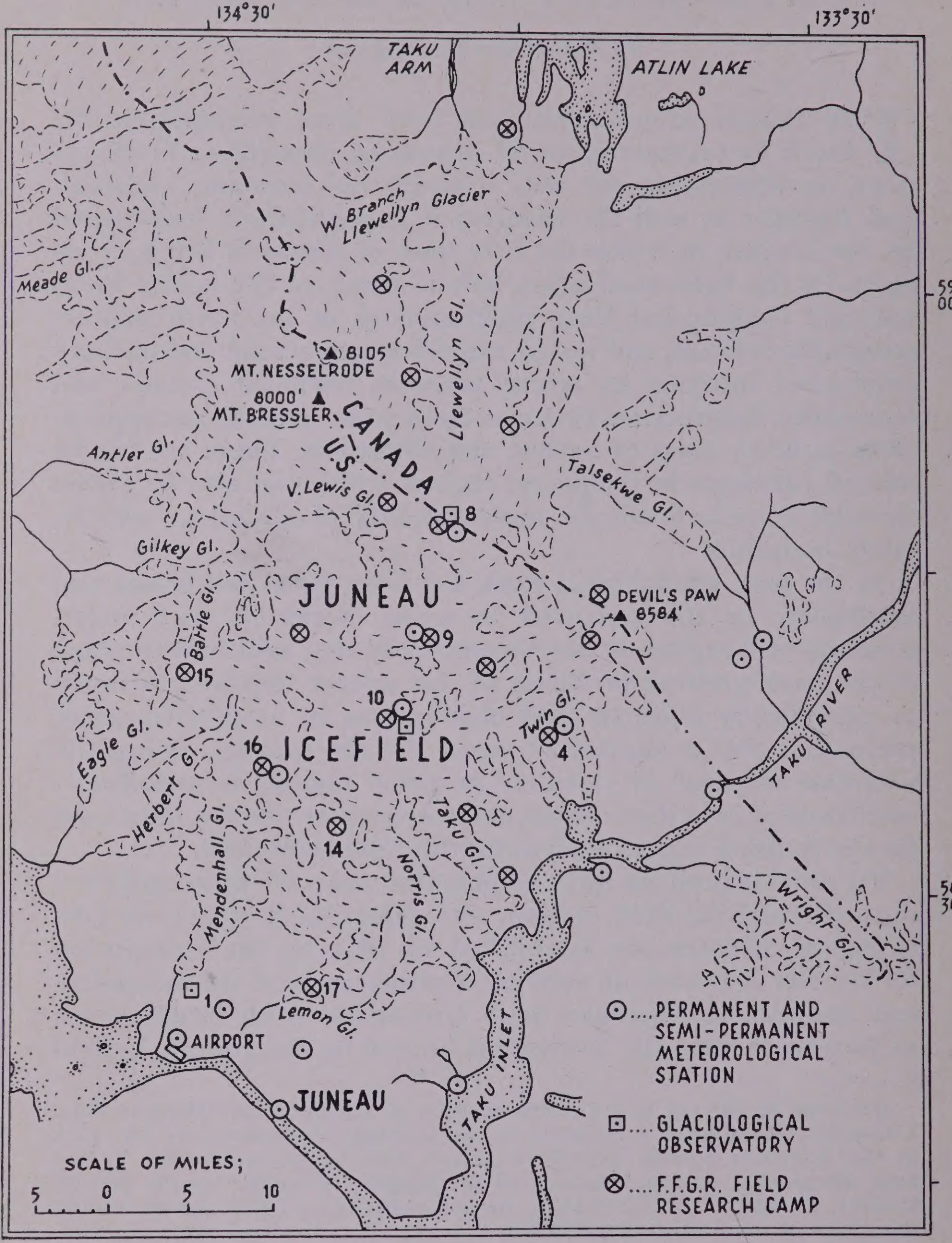

SKETCH MAP OF THE JUNEAU ICE-FIELD AND VICINITY SHOWING FIELD METEOROLOGICAL AND GLACIER RESEARCH STATIONS 1952-63. EACH OF THE MAIN PERMANENT STATIONS OF THE FOUNDATION FOR GLACIER RESEARCH ARE NUMBERED. GLACIOLOGICAL INSTITUTE HEADQUARTERS AT SITE 1 (ELEV. 200') ON THE LOWER MENDENHALL GLACIER; AT SITE 10 (ELEV. 4000') ON THE MIDDLE TAKU GLACIER; AND SITE 8 (ELEV. 7000') ON THE UPPER LLEWELLYN GLACIER.

U.S. Forest Service

NEW GLACIOLOGICAL OBSERVATORY

in the panhandle area of southern Alaska.[2] The quota of fifteen students attending the Institute's first season was drawn from a dozen universities and research institutes throughout the United States.

The Institute is fortunate to have a collaborative affiliation with the U.S. Forest Service. Its new half-million-dollar Glaciological Observatory located at the edge of the icefield at the terminus of the Mendenhall Glacier fifteen miles northwest of Juneau is thus available to the Institute as a demonstration and instructional center. In addition, the facilities of the Foundation's Juneau Icefield Research Program are available, consisting of eight permanent high camps which provide housing, research, and classroom space. Their locations are noted by number on the map. Camps 8 and 10 are the two main field headquarters of the Institute. Camp 10, located on the Taku Glacier, is about thirty air miles north of Juneau. Camp 8 lies eighteen miles farther up-glacier near the 7,000-foot crest of the range on that portion of the icefield shared by the Taku and Llewellyn glaciers and the Vaughan Lewis and Gilkey névés.

The permanent high camps consist of wooden structures sheathed with aluminum and situated on rock islands in the névés at elevations from 3,500 to 7,000 feet. At Camp 10, five buildings and attendant facilities include a new 46-foot Institute building housing classrooms, laboratory, and shower space. Each of the main buildings is double-floored and well insulated with fiberglass, making them exceptionally comfortable under storm or low-temperature conditions.

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[2] Reports on this work have appeared in previous editions of APPALACHIA, i.e., XXVI: 412-13; XXVII: 113-15, 202-4, 377-8; XXVIII: 261-3, 433-7, 484-6, 579-80; XXIX: 37-9, 120-3, 602-5; XXX: 121-2; XXXIII: 440-51.

Twelve subsidiary sites with cached equipment, scientific instruments, and supplies complete the network of camps. A field library of 500 technical volumes has been placed at two of the Institute's larger camps. Field transmitters operating under a permanent FCC license and as part of the Alaska Civil Air Patrol communications net have been installed to insure adequate communication between field camps and the Institute's Juneau headquarters.

Air logistic support for the Institute was provided by the Alaska Air National Guard. Up to seven tons of supplies, equipment, and personnel per flight were transported in their 70,000 pound C-123J ski-wheeled, "Flying Boxcar" aircraft. Seven landings were made with this huge plane at the 3,500, 4,700, and 6,000-foot névés, in the 1961 season. A Cessna 180 ski-wheeled support plane was also used in addition to H-21 helicopters chartered in Juneau.[3]

The Institute's M29C weasel vehicles and oversnow vehicles were used extensively. The Sno-Travelers proved to be exceptionally well designed for over-névé travel and equipment haulage. With these vehicles, as many as ten sleds were hauled in tandem, and on a number of days as many as 200 miles traversed, much of

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[3] Supporting staff for the 1961 Institute: A/2c R. Boyer, T/Sgt. W. E. Christy, Lt. Col. W. Elmore, Capt. D. Fell, A. and N. Livingston, K. Loken, Maj. W. McKee, Maj. T. Norris, Maj. D. Stringer, L. Thomas, Jr., R. Warren.

OBSERVATORY AT TERMINUS OF MENDENHALL GLACIER

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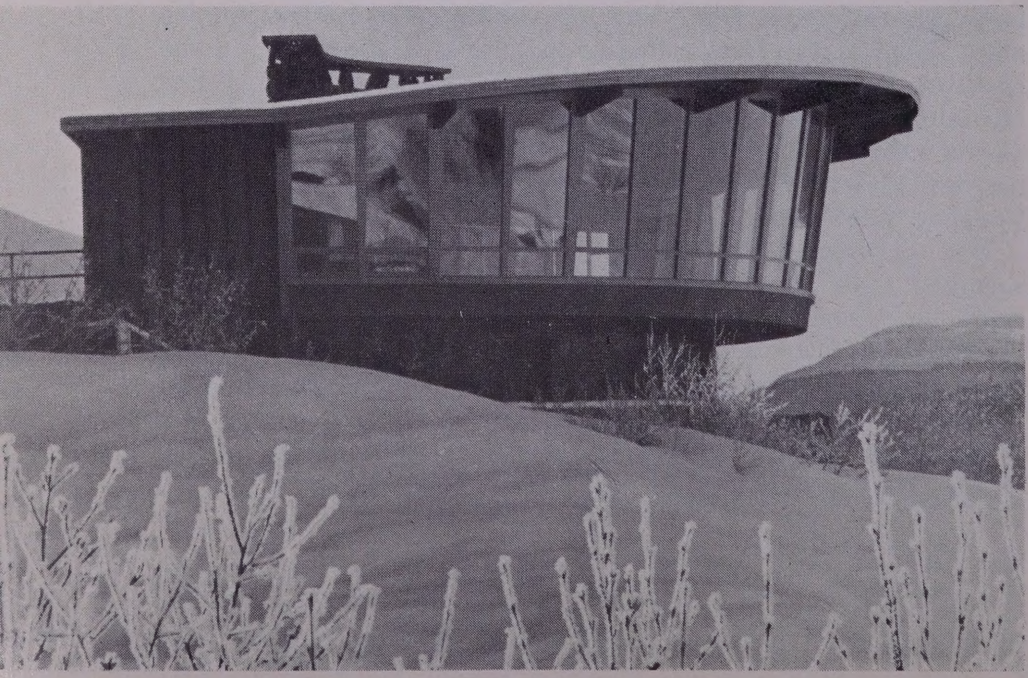


Foundation for Glacier Research, In

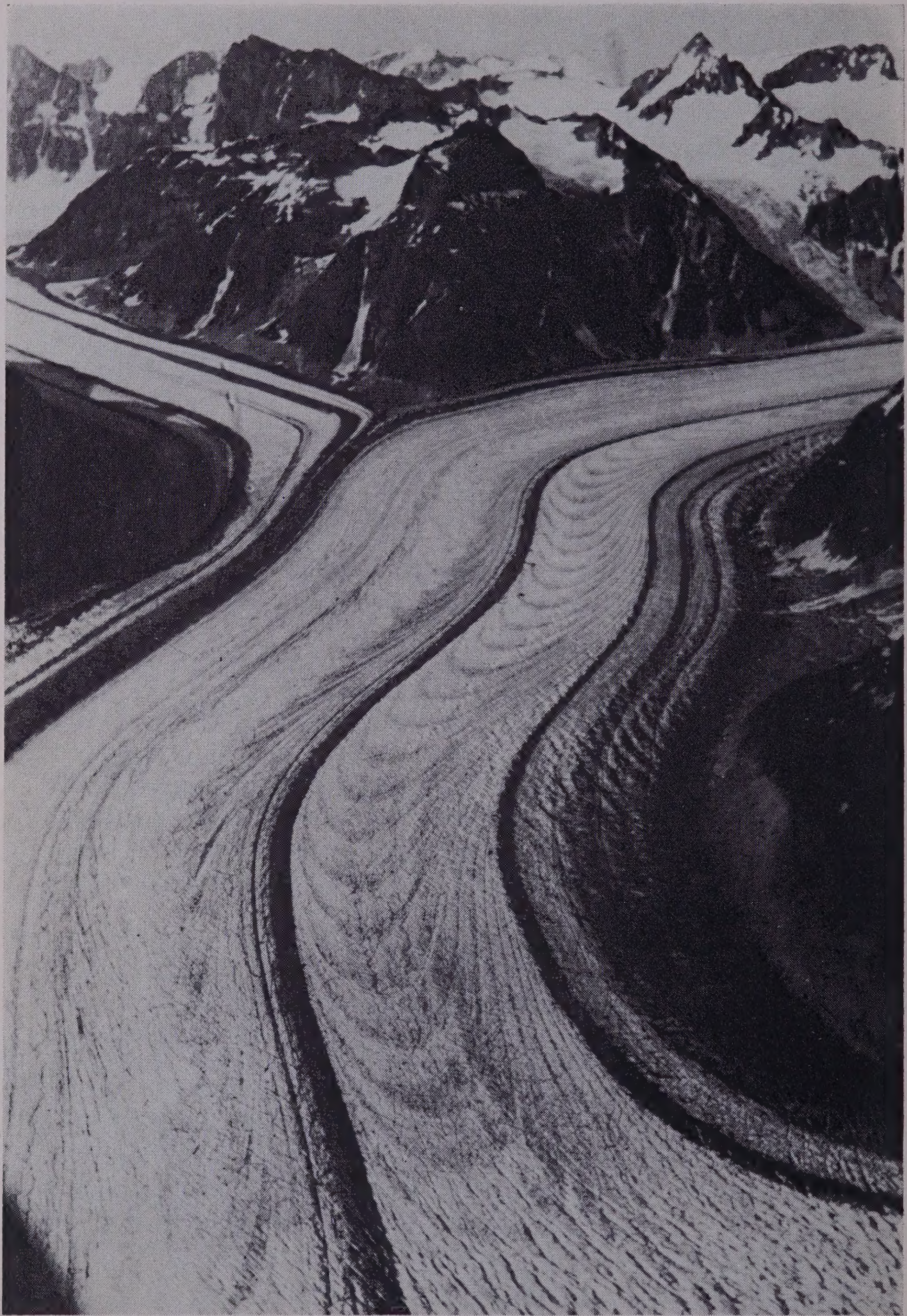
CAMP 8 AT 7,000 FEET

this in exploration of previously unvisited sectors of the icefield. The composite mileage covered by these mechanical "dog teams" equalled a journey from Juneau, Alaska, to Lansing, Michigan! These facilities and equipment made it practical to operate over an area comprising upwards of 2,000 square miles of glacial terrain.

Since, as a rule of thumb, each 1,000-foot change in elevation is climatologically equal to a 300-mile latitude change, the range in elevation on the Juneau Icefield makes it possible, within a few miles, to move from temperate conditions at sea-level to near polar conditions at the crest of the coast range. This means that the Institute can provide practical field experience in a variety of sub-Arctic to high-Arctic environments. The uppermost camps lie at the present ice divide. Here our expeditions have recorded winter temperatures of close to —90°F.

The setting is one of vast glacial and mountain landscape, in the heart of which every possible feature of glacial erosion can be seen. The margins of the icefield are characterized by a spectacular array of cirques, fiords, Pleistocene berms, U-form valleys, and other erosional forms, as well as a wide variety of glacial and fluvial depositional features. The composition of the exposed bedrock varies from low-grade metamorphics to migmatites and granodiorites in addition to peripheral sedimentary and volcanic outcrops. Timberline rests at 2,200 feet, with a maritime climate in the southern and western sectors and a subcontinental to continental climate on the northern and eastern flanks of the range.

The finest scientist in the world could not be effective in such a region unless he knew how to handle himself safely on glacial terrain. During both the 1961 and 1962 sessions, instruction was



*Maynard M. Miller*
*Courtesy Foundation for Glacier Research, Inc.*

GILKEY GLACIER AND BERNERS TRENCH

given in ski and mountaineering techniques, equipment, and safety. This included demonstrations in rope work, crevasse exploration, rescue procedures, and other mountaineering and skiing skills. No one has left at the end of the Institute sessions without having been subjected to severe blizzards, nor without having been involved in many practical field problems and their solutions, from arduous backpacking tasks to generator and radio repair, oversnow vehicle techniques, carpentry and cooking chores, and a fair proportion of roped cross-country travel and glacier bivouacking. This, in essence, means practical training in mountain and Arctic expeditionary living and survival techniques.

The Institute program combines instruction in the form of lectures with an extensive program of field studies in glaciology and glacial geology.[4] The 1961 Institute, held from mid-July through September, carried on inter-disciplinary field work and study of the factors responsible for Cordilleran glaciation in the Northern Boundary Range of Alaska, British Columbia, and the Yukon Territory. Effort was concentrated in two main areas: the broad high level crestal névés of the present glacial position, and the lower zones of restricted and former glaciation well below the regional névé line.

Six weeks were spent on the Juneau Icefield proper, particularly in the region of the Mendenhall-Taku-Llewellyn Glacier systems. The remaining three weeks were used for travel and observations by boat and aircraft in the low-level glacier termini sectors between Taku Fiord and Skagway, and in the neighboring districts of Glacier Bay and Yakutat Bay. These field trips provided examples in glacial geology and demonstrations of the regional patterns of Pleistocene and Little Ice Age fluctuations. Especially tantalizing were the problems of glaciers from the same névé zones which are simultaneously advancing and receding. The observations on the Juneau Icefield were applied in an effort to relate frontal behavior to alternations and trends in the upland zones of nourishment.

Students[5] were instructed in research instrumentation in glaciology and in methods of regimen assessment. They were also

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[4] Funding for the instructional program was provided by Michigan State University, the Gulf Oil Corporation, the Reader's Digest Foundation, and private sources. Support for the research activities was received from the National Geographic Society, the American Philosophical Society, the Foundation for Glacier Research, the U.S. Air Force, Polaris Industries, Inc., the Bendix Aviation Co., and the Abrams Aerial Survey Co.

[5] 1961 Institute Field Party: E. C. Andress, B. R. Anderson, J. H. Anderson, D. K. Bingham, P. A. Freers, T. F. Freers, T. R. Haley, J. Harmon, K. A. Henderson, R. Immonen, C. Jenkins, E. L. Keithahn, C. Kern, W. B. Lockwood, Jr., J. Lundberg, M. M. Miller, M. Porter, D. M. Potter, III, D. M. Potter, IV, B. W. Prather, G. Scott, T. Stewart.

*Foundation for Glacier Research, Inc.*

ON HIGH NEVE NEAR MOUNT BRESSLER

trained in snow- and firn-profile techniques, glacio-thermal measurements and analyses, surface and sub-surface glacier movement surveys, structural glaciology, field meteorology, glacio-climatology and related mapping, and pertinent aspects of glacio-ecology, bedrock geology, and arctic-alpine geomorphology.

In 1962 the Institute began in mid-June, thus extending its season by one month. It opened with an advance party hike to the central icefield camps to open stations, assemble and check oversnow vehicles, install new generator and communications equipment, and to initiate a summer glacio-meteorological records gathering program. By mid-July all students and Institute personnel[6] had been transferred to the icefield camps by helicopter and the ski-equipped C123J.[7] Between the middle of June and July 4, the weather was dismal, with only eleven minutes of sunshine recorded. During most of July and August, however, superb weather prevailed—the finest for high elevation field work since the start of the Juneau Icefield Research Program in 1946.

The emphasis was on graduate instruction. Five students were working on Master's thesis problems and two on Ph.D. theses. Lectures and seminars were conducted on topics of periglacial physiography and arctic-alpine lichen—their distribution, identification, and the use of their established growth rates as indicators of the age of deglaciation on exposed rock surfaces. There were additional lectures on related glacio-anthropological subjects, covering the development of Alaskan coastal Indian culture since the Thermal Maximum. These took up the problem of coastal and interior migrations during the climatic fluctuations of the Little Ice Age and the relationship between anthropology and the glacio-climatic history of the Northern Pacific coastal regions, with special reference to the chronology of prehistoric Aleut, Eskimo, and Moyoro cultures in eastern Asia and Alaska. This latter was of special interest in view of the undoubted role of glacier fluctuations and related climatic changes in the migration of early man into North America from Asia late in Pleistocene time.

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[6] 1962 Institute Field Party: N. Anderson, T. Bank, S. Beeson, F. Dunham, L Edmond-Hamelin, C. Egan, F. Fisher, F. Gabl, W. Hiltner, O. Homeister, H. Imshaug, P. Kakela, A. Kennedy, E. Kiethahn, M. McCaul, P. McRoy, J. W. Miller, M. M. Miller, R. Miller, D. M. Potter, IV, B. W. Prather, J. Sawyer, N. Simmons, D. Swanston.

[7] Supporting staff for the 1962 Institute: Sgt. H. V. Choate, T/Sgt. R. C. Creach, Col. W. Elmore, A. and N. Livingston, K. and P. Loken, Capt. R. R. Wathers.

The research problems dealt with in the 1962 session ranged from an assessment of depth and geographic distribution of the 1961-62 snow-pack and firn stratigraphy to sub-surface thermal conditions measured with strings of resistivity thermometers inserted into boreholes. One of the interesting results of the session was the discovery of extensive stone circle and stone stripe structures on frost-shattered nunatak surfaces from the continental to maritime sectors of the icefield. Lichen specimens were col-

VIEW UP THE MENDENHALL GLACIER AND
PERIPHERAL RANGES OF THE JUNEAU ICEFIELD

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lected on a large number of nunataks, with a control study in the Mendenhall Glacier valley. To further the detailed studies of the Mendenhall Glacier system sub-surface borehole and pit investigations were made in the upper reaches of this glacier's névé. The bedrock geology mapping program was extended onto the high Gilkey Glacier and Mt. Bressler névés along the Canadian border. A permanent display of several hundred geological and lichen specimens was set up in the new Institute classroom building at Camp 10 as a practical adjunct to this and future study programs. To supplement this project, a large number of choice Alaskan mineral and type ore samples were donated to the Institute by the Alaska State Museum.

At the end of the field season, the students were taken on a trip into Glacier Bay[8] where nearly 1,000 square miles have been uncovered by the phenomenal shrinkage of glaciers just since the 1790's. The comparison provided with the Taku Glacier complex, which in the same interval of time has been experiencing a dramatically opposite pattern of glacial growth, was striking. Consideration of the glacio-climatological causes of this paradoxical situation brought the academic and research program more sharply into focus.

In effect, then, the icefield has served as a practical training laboratory for Arctic logistics as well as a field laboratory for continuing scientific work. Out of such extensive operations and experience, the concept of this field Institute in Glaciological and Expeditionary Sciences has evolved. The broader contribution of this program to our nation's readiness and welfare in Arctic matters has been growing. With the Institute's instructional and research offerings and the array of field facilities now available for use, it is our hope that the objectives of the program will increasingly be achieved.

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[8] L. J. Mitchell, Superintendent of the National Monument, provided a 70-foot National Park Service vessel and crew assistance in the field.

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MILLER, Maynard M.
AUTHOR

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